DOE Transmission Reliability Program Review

Real-Time Grid Reliability Management

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Consortium for Electric Reliability Technology Solutions

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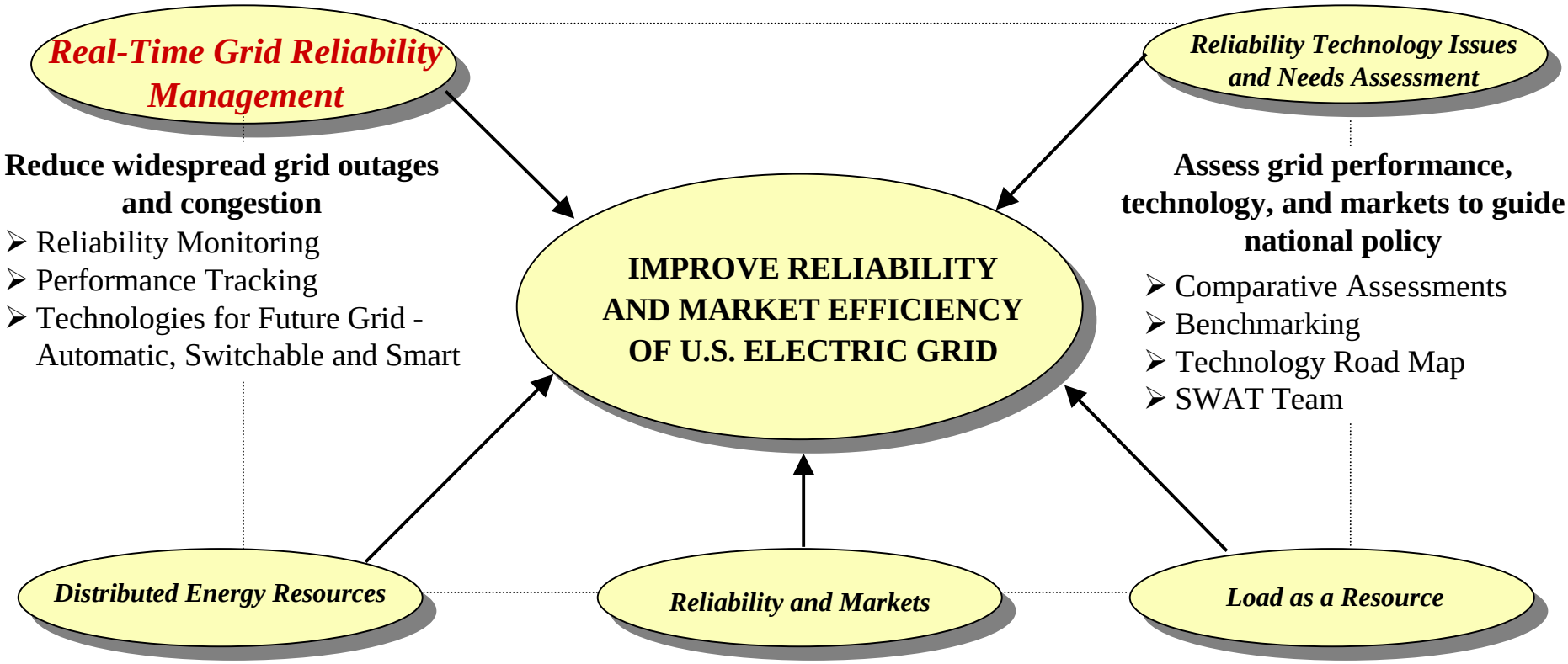
Discussion Topics

1. Vision and Objectives
2. Roadmap for Research, Demonstrations and Dissemination
3. Past Accomplishments
4. Preview of Grid 3P Framework
5. Selected RTGRM Reviews for Today and Tomorrow

Mission, Goals, and Interactions by Research Area



Reduce widespread grid outages and congestion

- Reliability Monitoring
- Performance Tracking
- Technologies for Future Grid - Automatic, Switchable and Smart

Assess grid performance, technology, and markets to guide national policy

- Comparative Assessments
- Benchmarking
- Technology Road Map
- SWAT Team

Integrate DER and improve customer and grid reliability

- Micro Grids
- Utility DER Integration
- Customer DER

Improve Market Efficiency and Grid Reliability

- Test Market Designs
- Integrate With Market Monitoring and Controls
- Market Simulations

Integrate loads to respond to market price signals and grid reliability control

- Load Aggregation
- Pumping Load Control
- Integration With Grid Control

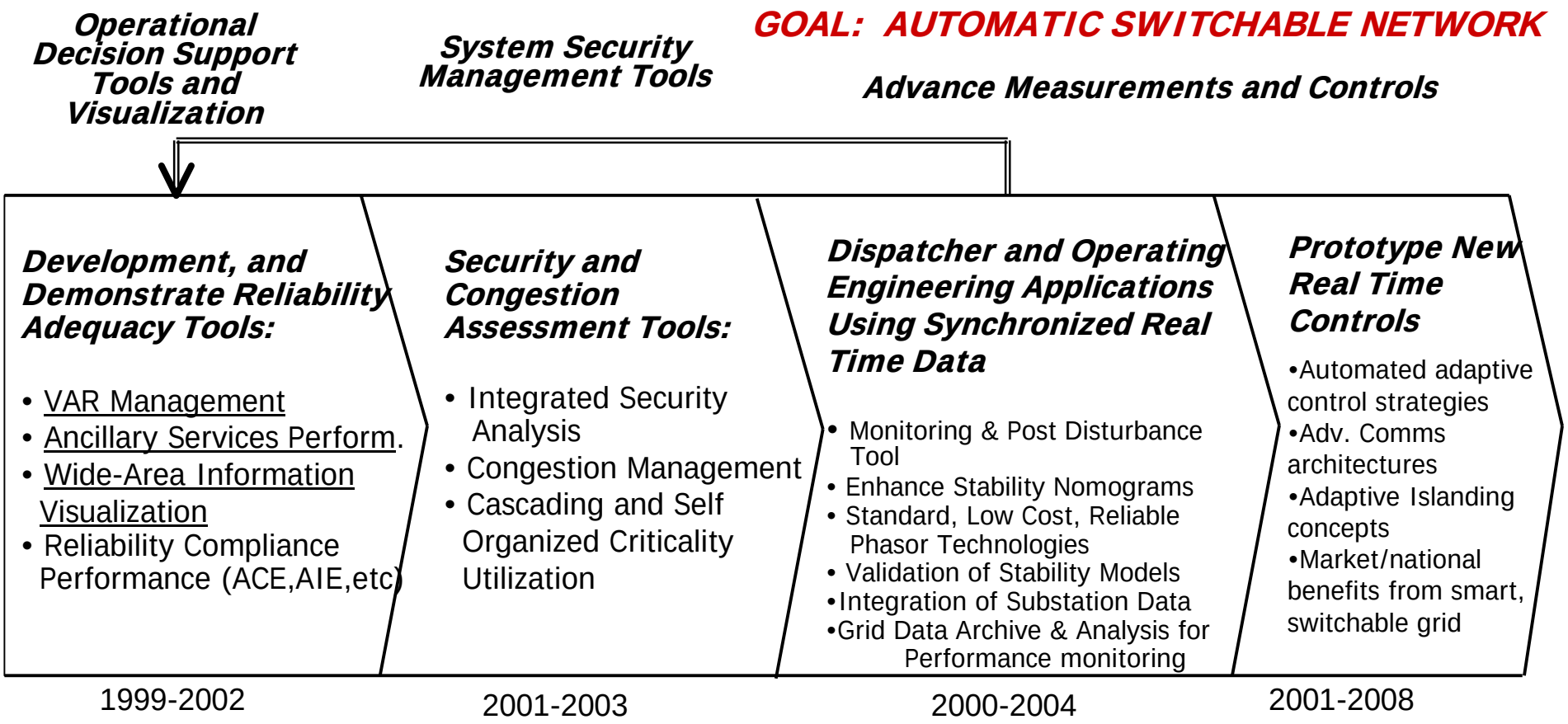
Real-Time Grid Reliability Management

Vision/Goal: *Transform the electric grid to an automatic switchable network*

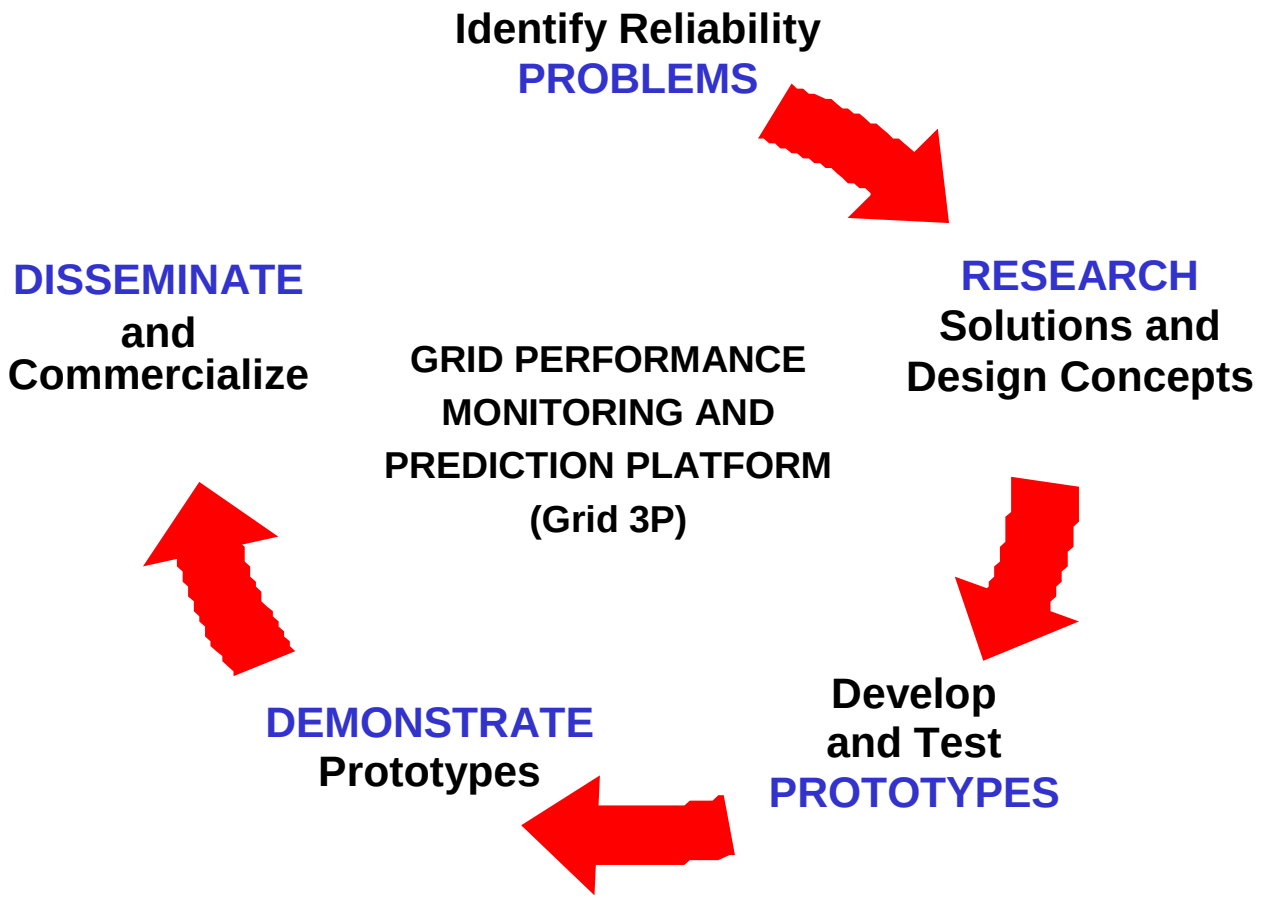
Research Objectives

- Identify current operational requirements/assess the suitability of current operational tools and security schemes for wide control areas operated in market-driven conditions;
- Develop, test, and evaluate new real-time performance monitoring, reliability adequacy, and security analysis schemes, tools, and operational procedures along with corresponding real-time control technologies based on advanced measurements;
- Demonstrate the above tools, schemes , and controls utilizing ISOs, RTOs, and utilities as test beds;
- Improve information visualization systems and their availability, so that operators can rapidly understand and react to developing system problems in new market-based operational environments; and
- Pursue a dissemination strategy to accelerate introduction of the operational tools and processes by making them readily available to industry.

Real-Time Grid Reliability Management



Reliability Goals and Objectives



RTGRM Research Road Map – Selected Elements

Project/ Research Area	PROBLEMS To Address	RESEARCH	Develop PROTOTYPES	DEMONSTRATE	DISSEMINATE
Visualization Tools	CAISO – Real Time Data Overload 1999	Develop Graphic and Geographic Displays 1999/2000	Test Displays With Operators 2001	Demonstrate Prototypes at CAISO, PJM, NERC – 2001	Integrate Visualization Tools with Reliability Management Applications – 2002
Voltage Management System (VMS)	Voltage Collapse WSCC – 1996 PJM – 1999	Develop VMS for Monitoring, Tracking, and Displays 1999/2000	Test Prototype at CAISO 2001	Demonstrate and Install Prototype at CAISO 2001/2002	Disseminate VMS to ISO's and SCADA Vendors 2003
Area Control Error (ACE)	NERC – Need Tools for Reliability Authorities 2000	Develop System Design 2001	Test Displays and Prototype at NERC 2002	Release Prototype to ISOs/Control Areas: TVA, SPP, MISO, VACAR/ IMO, CAISO 2002/2003	Release to all 23 Reliability Authorities and 12 Control Areas 2003
Area Interchange Error (AIE)	NERC – Need Tools for Reliability Authorities 2000	Develop System Design 2001	Test Displays and Prototype at NERC 2002	Prototype for Use by ISO's 2003	Release to all 23 Reliability Authorities and 12 Control Areas 2003
Phasor Measure-ment System	Outages 2000	Evaluate Wide Area Measurement and Phasor Applications 2000/2001	Test Applications at AEP, TVA, WAPA 2001-2003	Integrate Prototypes with SCADA 2003-2004	Disseminate to ISOs and Vendors 2005

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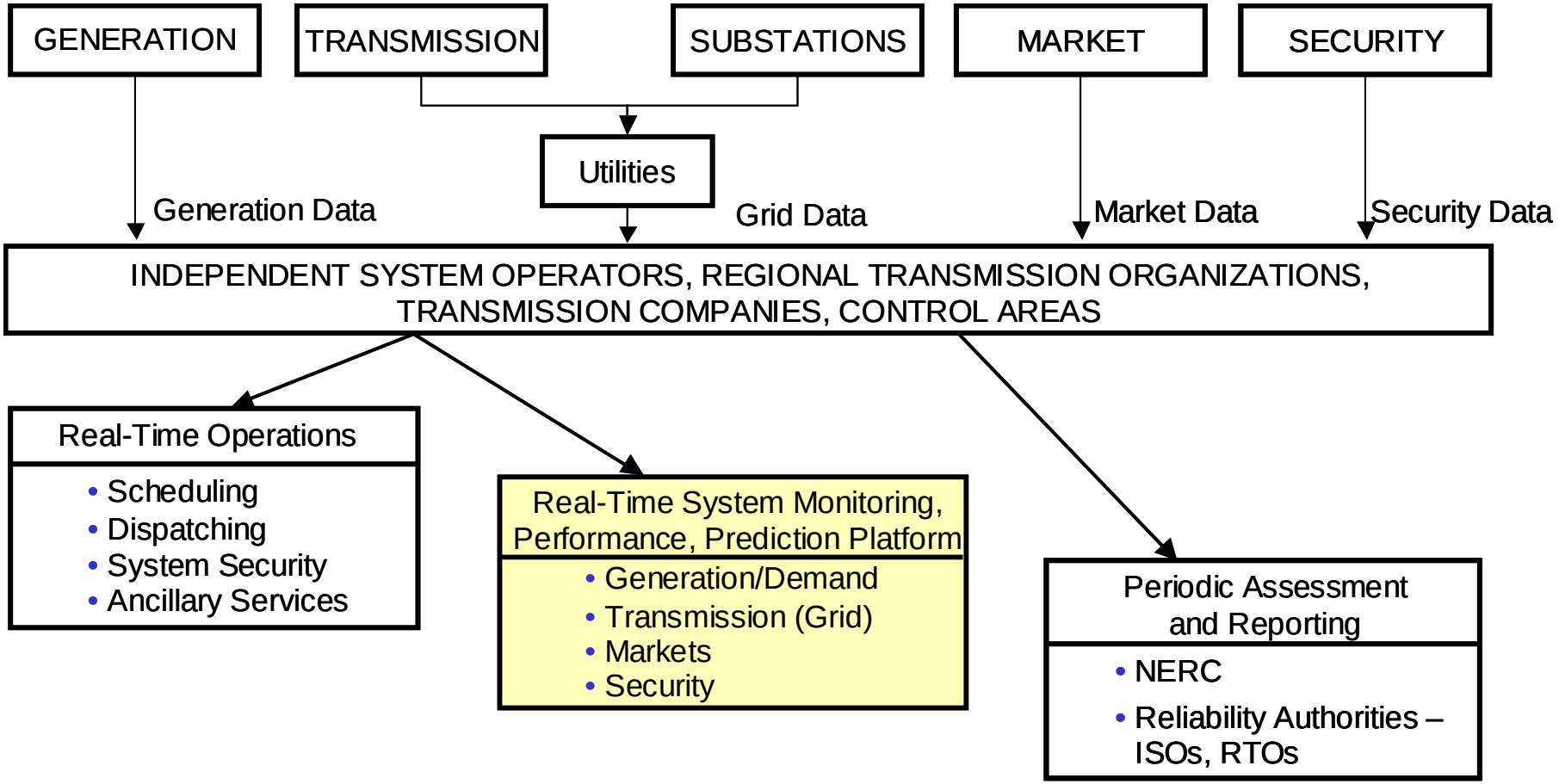
RTGRM Tools Demonstrations

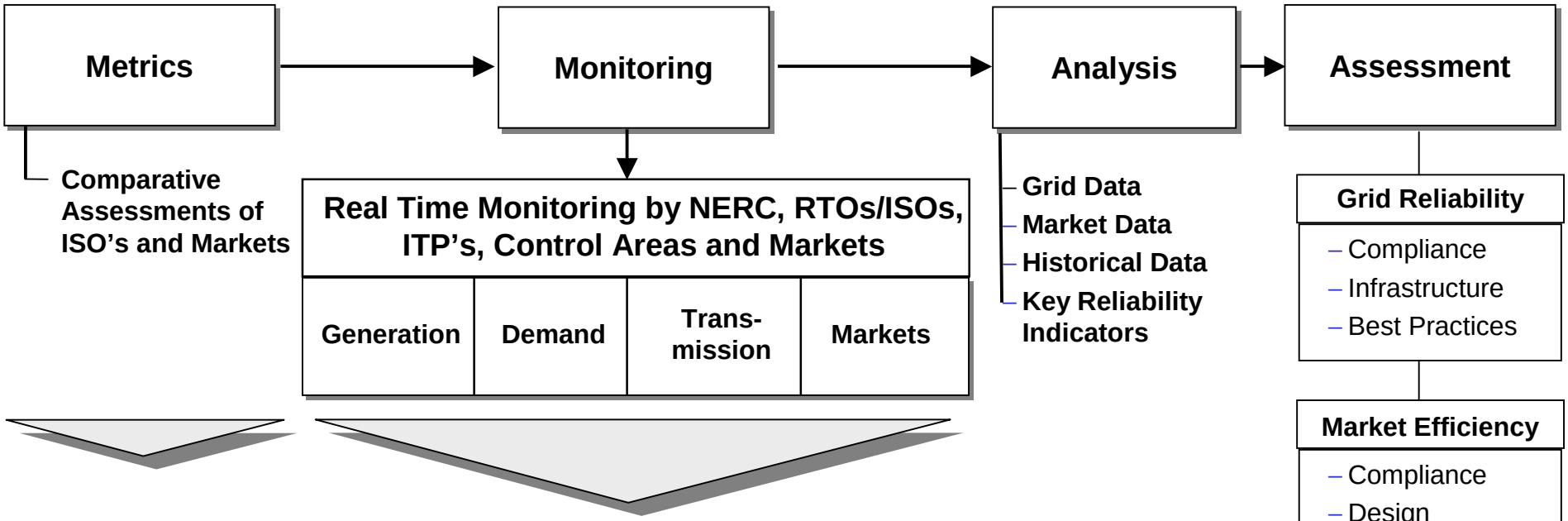
- **CAISO** - California Independent System Operator - Voltage Mgmt. & Reserves
- **NERC** - North American Electric Reliability Council - Frequency (ACE/AIE)
  - In beta test with 7 Security Coordinators and utilities including:TVA, SPP, MISO, VACAR North, IMO, CISO, Rocky Mt./Desert system
- **AEP** - American Electric Power - Outages With Phasor Measurement
- **WAPA*** - Western Area Power Administration - Visualization
- **TVA, MISO, PJM, Nat Grid*** - Outages With Phasor Measurement
- **NEISO*** - Northeast Independent System Operator - Frequency
- **NYISO*** - New York Independent System Operator - Frequency

***Under Discussion**

CERTS Technology Platform for Real-Time Grid Monitoring



CERTS Framework for Grid Metrics and Real Time Performance Monitoring



To:

- DOE
- FERC
- ISOs/RTOs

Reliability:

- ACE - AIE
- Frequency
- Frequency Reserves
- Voltage - VARS
- Transmission Loadings

Markets:

- Price Spikes
- Energy Imbalances
- Reserves
- Market Power
- Transmission Congestion

Selected RTRGM Presentations
*Today and **Tomorrow***

- Reliability Adequacy Tools
  - Reliability Adequacy Tools – NERC ACE/AIE (Carlos Martinez)
  - Reliability Adequacy Tools Outreach / Eastern Interconnection Advanced Measurements Demonstration (Carl Imhoff)
- System Security Management Tools
  - Integrated Security Assessment (Pete Sauer)
- Advanced Measurement and Control
  - WSCC Performance Testing and Model Validation Support / Advanced Measurement Solicitation (Matt Donnelly)
  - Feasibility of Real-Time Control (Anjan Bose)
  - Self-Organized Criticality (Ian Dobson)